LIMSource

An Introduction to LIMS

Laboratory Information Management Systems (LIMS) are information management systems designed specifically for the analytical laboratory. This includes research and development (R&D) labs, in-process testing labs, quality assurance (QA) labs, and more. Typically, LIMS connect the analytical instruments in the lab to one or more workstations or personal computers (PC). These instruments -- such as chromatographs -- are used to collect data. An instrument interface -- such as an integrator -- is used to forward the data from the chromatograph to the PC, where the data is organized into meaningful information. This information is further sorted and organized into various report formats based upon the type of report required.

Originally, LIMS were developed in-house by organizations wishing to streamline their data acquisition and reporting processes. In-house LIMS, which are still being developed by many organizations, can take considerable time and resources to implement. The need for a more immediate solution helped drive LIMS to the next stage in the 1970s. During this time, custom-built systems became available. These early custom systems were one-off solutions designed by independent systems development companies to run in specific laboratories.

Parallel to these custom-built LIMS implementations were the initial efforts to create commercial LIMS products. These extensive research efforts resulted in the first commercial solutions that were formally introduced in the early 1980s. Such commercial LIMS were proprietary systems, often developed by analytical instrument manufacturers to run on the chromatographs that the instrument manufacturer manufactured.

These commercial systems, while typically developed for a particular industry (such as the pharmaceutical industry), still required considerable customization to meet a specific laboratory's needs. In particular, laboratories often expect -- and in many cases require -- very specific format and reporting requirements. However, such demands for customization increase the cost of the commercial LIMS and extend the implementation time.

Parallel to the rise in commercial LIMS was the increase in processing speed; the increase in third-party software capabilities; and the reduction in PC, workstation and minicomputer costs. These advantages have been transferred to the laboratory and LIMS environment.

As a result, the migration away from proprietary commercial systems toward an open systems approach is in full swing. Now, commercial LIMS offer increased flexibility and functionality. Many of today's most popular commercial LIMS take advantage of open systems architectures and platforms to offer client/server capabilities and enterprise-wide access to lab information.

The following chronology gives a concise view of the development of LIMS since computers began to replace notebooks in the lab.

LIMS Development

Pre-1982 Laboratory notebooks and handwritten reports/charts were used to track and report information. Rudimentary in-house information systems were configured by a handful of technologically-adept laboratories. Custom-built LIMS became available from third-party vendors.

1982 The first commercial LIMS, known as first generation (1G) LIMS, are introduced. These 1G LIMS placed laboratory functions onto a single centralized minicomputer, providing greater lab productivity and functionality as well as the first automated reporting capabilities.

1988 Second generation (2G) LIMS become available. 2G LIMS utilized the available market technology of third-party commercial relational databases (RDB) to provide application-specific solutions. Most 2G LIMS relied on minicomputers, but PC-based solutions were beginning to emerge.

1991 The move toward open systems ushered in third generation (3G) LIMS, which combined the PC's easy to use interface and standardized desktop tools with the power and security of minicomputer servers in a client/server configuration. A client/server architecture splits the data processing between a series of clients and a database server that runs all, or part of, the relational database management system (RDBMS).

1995 Fourth generation (4G) LIMS decentralize the client/server architecture further, thereby optimizing resource sharing and network throughput by enabling processing to be performed anywhere on the network. Thus, all clients and servers can operate in either capacity depending upon the data load at any particular instance.

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